



NASA STTR 2012 Phase I Solicitation

T1.01 Launch Vehicle Propulsion Technologies

Lead Center: MSFC

Participating Center(s): SSC

Heavy lift launch vehicles envisioned for exploration beyond low Earth orbit (LEO) will require large first stage propulsion systems. For some heavy lift vehicles, the total thrust produced at lift-off will exceed 6 million pounds. There are currently available practical propulsion options for such a vehicle. However, the cost for outfitting the booster with the required propulsion systems is in the hundreds of millions of dollars. This cost severely limits what missions NASA can perform. Low cost design concepts and manufacturing techniques are needed to make future exploration affordable. This topic seeks technologies that will fulfill the following objectives:

- Development of propulsion concepts whose cost is less than 50% of currently available but with similar performance.
- Development and demonstration of low-cost manufacturing techniques.
- Techniques for evaluating and analyzing low-cost, easily manufacturable design concepts.

Example technologies of interest include:

- Ablative materials and manufacturing techniques.
- Innovative chamber cooling concepts that reduce manufacturing complexity without reducing performance.
- Low-cost nozzle materials, manufacturing techniques, and coatings.
- Ignition concepts that require low part count and/or low energy to be used as either primary or redundant ignition sources.
- Manufacturing techniques that lower the cost of manufacturing complex components such as injectors and coolant channels. Examples include, but are not limited to, development and demonstration of rapid prototype techniques for metallic parts, powder metallurgy techniques, and application of nano-technology for manufacturing of near net shape manufacturing.
- Increased efficiency and fidelity analysis tools.

The development of future propulsion systems for deep-space exploration are directly dependent on the development of technologies such as those listed. Furthermore, affordable, reliable access to space technology is a strong need across all of NASA's space exploration activities (HEOMD, OCT, SMD). While revolutionary advances in launch vehicle technologies are not foreseen to be developed in the immediate future, a practice of employing methodical continuous technology development in the direction of lowering the cost and improving the reliability of launch propulsion systems will addresses this critical need of lowering the cost of earth-to-orbit launch systems and capabilities.